Avionics R&D
for CNS/ATM Environment
in China

CARERI

Chinese Aeronautic Radio Electronics Research Institute

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Part I: Status of CNS/ATM

- CAAC announced its CNS/ATM implementation policy on January 1, 1995
  - Promise to adopt the CNS/ATM concept recommended by ICAO
  - Form a leadership commission, executive office and expert consulting group
  - Prompt to collaboration with international community

CAAC implementation policy (1)

☐ Technology policy
  ☐ Communication
  - Test and finally set up some satellite communication system for voice and data communication
  - Set up a satellite communication net for domestic telephone service, data net, telegram service, meteorological and navigation information service, airlines data transfer service
  - Continuously develop the VHF data link net
  - Develop OSI based ATN net

CAAC implementation policy (2)

- ☐ Navigation
  - ☐ GNSS technology for route, terminal, non-precision and precision approach
  - ☐ Active attitude forward to R&D the procedures for GNSS based CAT II and III approach application
  - ☐ Application of RNP concept
  - ☐ Stop the R&D of MLS in CAAC application

CAAC implementation policy (3)

- ☐ Surveillance
  - ☐ Implement the flight test for application of ADS/SAT technologies over western of China and over ocean
  - ☐ Use Chinese satellites for domestic area and an international satellite system for international area with standard interface
  - ☐ CAAC will hold the net management

CAAC implementation policy (4)

- ☐ ATM
  - ☐ R&D of automatization test and application of ATS flight planning and flow control
  - ☐ R&D of procedures for CNS/ATM applications
  - ☐ R&D of integration of subsystems for ATM system applications

Current Engineering Development in China

- ☐ FANS-L888, First Airway for CNS/ATM
    - ☐ On January 10, 2001, the first airway for CNS/ATM application in China is officially opened. The new Asia-Europe route over China has distance of 2800 km from southeastern to western China, but 700 km shorter than the present one
- ☐ ACARS Data Link for eastern and southeastern China
    - ☐ Here flight flow is over 70 percent of CAAC biz

Avionics Application

- ☐ Carrying on the R&D of airworthiness for Avionics toward to CNS/ATM environment

- ☐ Speed up the update of CNS/ATM FANS-I function increment for CAAC whole fleet

- ☐ Some key airborne equipment to be development by industries

Part II: Current R&D in Avionics

- ☐ Data Link Function
- ☐ Flight Management Function
- ☐ Key Sensors

Data Link Subsystem (1)

☐ VHF Data Link Function

    ☐ The ground station is support by ARINC.Inc

    ☐ Airborne equipment is support by international vendors

☐ New Data Link Function

    ☐ Toward to CNS/ATM environment

    ☐ Carrying on R&D, leading by domestic industries

    ☐ Mode 3 or 4 are first candidates

Data Link Subsystem (2)

□ Airborne equipment

    □ Voice and Data communication in one

    □ Air - Air, Air - Ground capability for CPDLC,ADS and DGPS function

    □ Multi-Band for HF, VHF and UHF

    □ Multi-Mode for AM/SSB/BSB, ACARS and STDMA voice and or data transfer

   □ Multi- Interface for ARINC and RS-242

Flight Management Function (1)

- □ Two modes
  - □ Traditionally, FMS based on "Navigation" Function
  - □ Or, FMS based on new channel of "Communication" Function
    - New Radio Communication and Navigation integrated equipment system with entire FMS Function from Take /off to Approach

Flight Management Function (2)

☐ One R&D System for Our Potential Regional Aircraft project
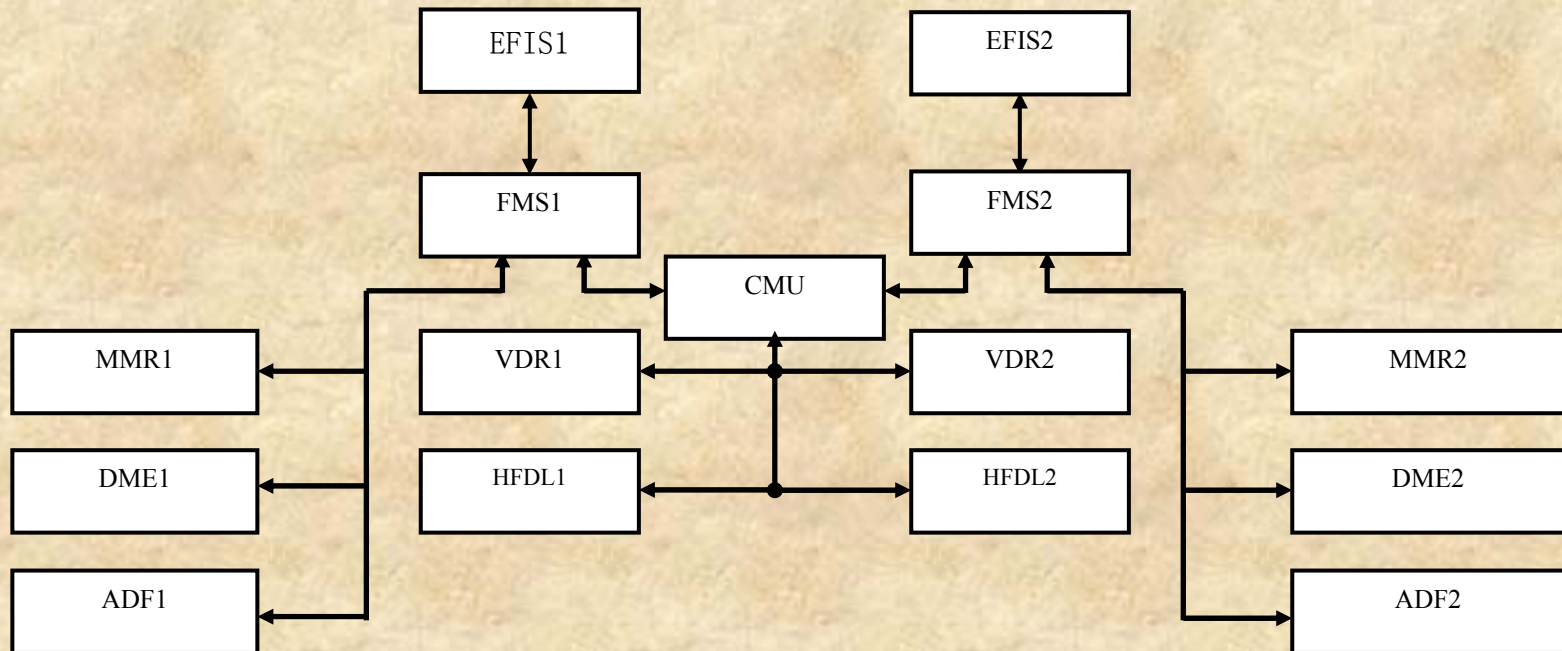
Key Sensors

☐ GNSS Sensor
- ☐ GPS/GLONASS Function

☐ Multi-Mode Receiver - Digital
- ☐ Radio/processor capable of receiving ILS, GPS source inputs
- ☐ GLONSS and MLS source inputs may be added, but not required immediately
- ☐ Industry still keeps some R&D in MLS

Part III:
Increasing Needs in Future (1)

◻ **Data Link Function**

    ◻ ADS Mode Consideration

        • ADS-B first

    ◻ Some flight test with different bands

        • VHF/UHF, HF channels

◻ FMS Function

    ◻ New launched projects, including a new Regional Aircraft for domestic market

    ◻ Some applications of updating existing fleet plans

Part III: Increasing Needs in Future (2)

- ☐ ATM subsystem
  - ☐ Automatic Information Proceeding
    - Share flight information data
  - ☐ Space Planning and Management
    - Joint-use space, based on CAAC Operation
  - ☐ Flight Conflict Protection
    - Transit Control of en route management to CAAC
      - Main airways have been transited into CAAC step by step

Part III:
Increasing Needs in Future (3)

☐ **Regulation, System Update and Training**

  ☐ Standard and specification

    • CARERI is in the leading edge for avionics standard and specification for CNS/ATM environment. E.g.,CARERI is unique international associate member of RTCA in China mainland

  ☐ Operational regulation and procedures

    • CAAC is the main responsibility for preparing those rules, many international and domestic industries and academic units also involved

  ☐ System Update and Training

    • Industries and vendors play important roles

CARERI's Considerations for CNS/ATM Applications (1)

☐ Basic Principles

  ☐ A new avionics package for these applications

  - What is its definition and position

  - What is its basic functions

  - What is its efficacy in improving flight performance and most importantly, enhancing flight safety in increasing automatic flight environment

CARERI's Considerations for CNS/ATM Applications (2)

- ☐ The Core Is the Way of Automatization
  - ☐ Before CNS/ATM, avionics is an independent system in R&D, basically
    - Works with ground system, but independent R&D in itself way
    - Has been increasing in complex and overlap in function in different subsystems
      - e.g., we can get position information by INS and Radio navigation Subsystem
      - The function connection within it is not enough

CARERI's Considerations for CNS/ATM Applications (3)

☐ The Third Eye in Cockpit

  ☐ Avionics will be an *Electronic Manager* based on the CNS/ATM environment

  - For CNS/ATM environment, avionics will be a dependent subsystem mounted on the cockpit

  - Supported by CNS/ATM environment, avionics will be a simplified subsystem in guiding aircraft, but increasing its "surveillance" on flight behavior

  - Possibly extend its platform for entire information management of whole aircraft

Special Thanks

CARERI would like to take this opportunity to appreciate Glenn Center, NASA for its warm invitation. This supplies CARERI such a wonderful moment to come here, share ideas and make business friends.

CARERI would like to be an active partner in prompting R&D of avionics in CNS/ATM environment, and its applications